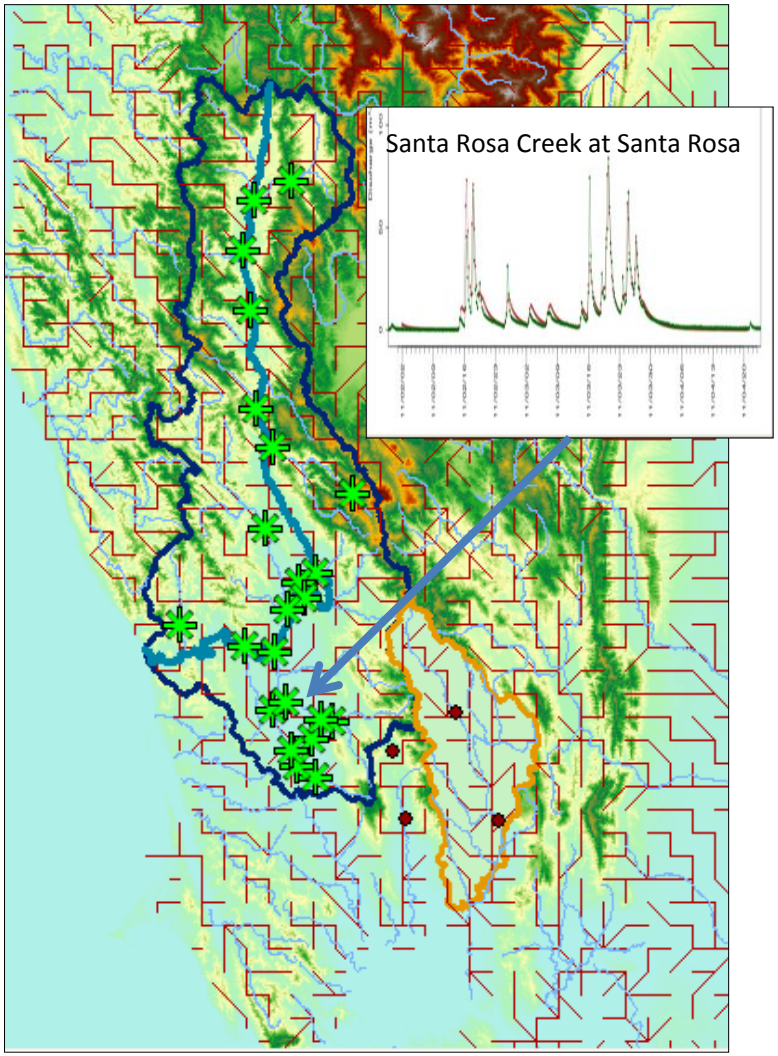
Russian River Tributaries Water Budget High Resolution Characterization of Historical, Current and Future Conditions

OAR (HMT), NMFS (HCD, RC, and PRD) and NWS (CNRFC, WFO – MTR and EKA, OHD)

June 2013

Russian River Tributaries Water Budget: Outline

- Objectives
- Project Description
- Participants
- Tasks and Schedule
- Gaps
- Partners and Outreach



Russian River Tributaries Water Budget: Objectives I

- Objective 1: Develop a hydrologic water budget model that estimates historical (unimpaired), current (impaired) and future flow conditions of selected Russian River tributaries
- Objective 2: Include estimates of current and future water demands within selected tributaries
- Objective 3: Design and deploy the hydrologic water budget model in a collaborative manner to aid stakeholders in understanding opportunities for coordinated operations
- Objective 4: Implement the distributed hydrologic model for use in local NWS Weather Forecast Offices for continuing forecasts of low and high flows

Russian River Tributaries Water Budget: How Objectives Are Supported

- Quantification of daily stream flow at 1-2 km^2 scale, when combined with appropriate life-stage-specific flow thresholds, will substantially improve the ability to assess current and historical flow conditions for salmonids
- The amount of impairment can also be used as a decision-support tool for other programs (e.g. RR Russian River Coho Salmon Captive Broodstock Program)
- By combining the high-resolution hydrologic modeling and flow monitoring with spatially explicit estimates of water demand, a water budget can be developed for planning at the sub-basin scale
- Comprehensive hydrologic data provided by this program will also support flood forecasting operations throughout the basin by providing reliable quantification of stream flows at all times of year at any location
- The collaborative hydrologic water budget modeling approach will involve stakeholders in data development, model review and incorporation of multiple perspectives

Russian River Tributaries Water Budget: Participants

- OAR Hydrometeorological Testbed (HMT)
- NMFS
  - Habitat Conservation Division
  - Restoration Center
  - Protected Resources Division
- NWS
  - CNRFC
  - WFO – Monterey (MTR) and Eureka (EKA)
  - Office of Hydrologic Development (OHD)
- NIDIS

Russian River Tributaries Water Budget: Tasks and Schedule

- Establish high density of observations in selected RR tributaries for weather, stream flow, soil moisture and groundwater – 1-3 years
- Develop distributed hydrologic water budget model for selected tributaries during low flow conditions – 1-3 years
- Extend observations network for real-time data via the internet for time-sensitive management needs – 3-5 years
- Characterize surface water – ground water interactions for the selected tributaries – 3-5 years
- Extend the RDHM to simulate stream flows and water budget in other RR tributaries – 3-5 years
- Deploy the hydrologic water budget model to support collaborative review of the model structure, data and results, and shared visioning – 1-5 years.
- Couple the distributed hydro model to rainfall forecasts and water management to support WFO forecasts and local decision making – 3-5 years

Russian River Tributaries Water Budget: Gaps

- Identification of gaining and losing reaches within selected tributaries, their hydrogeologic controls, and water uses which may influence flow conditions
- Definition of life-stage-specific flow/habitat relationships to be used for interpretation of model results in a manner that ties them specifically to the recovery of salmonids
- Knowing past, current and future water demands which may influence flow conditions

Russian River Tributaries Water Budget: Partners and Outreach I

- Certain or possible partners
  - SCWA
  - USGS - California Water Science Center and Ukiah Field Office
  - Sea Grant: Captive Broodstock Program
  - Matt Deitch, CEMAR
  - Adina Merenlender, University of California, Berkeley
- Outreach – Internal, partners, general public
  - NMFS, see above
  - Russian River Independent Science Review Board
  - Russian River basin water stakeholders

Russian River Tributaries Water Budget: Partners and Outreach II

- NOAA views this as an opportunity to pursue our preferred approach to conservation and stewardship
  - Which is via collaboration with stakeholders to develop solutions that are effective yet amenable to parties affected by them
- This is also an opportunity for the agricultural community to partner with climate specialists to improve water management in the region

Russian River Tributaries Water Budget:

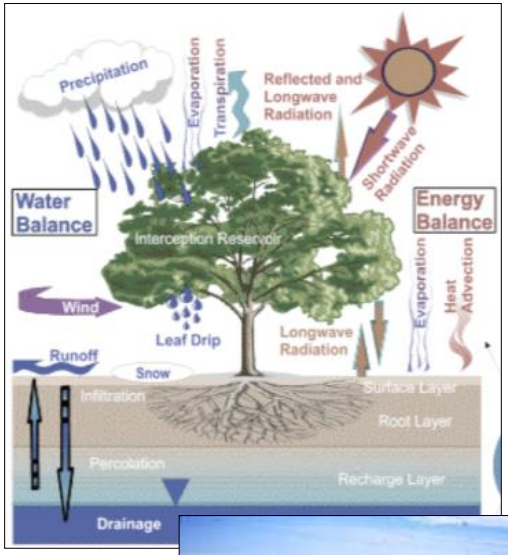
- Thanks

Russian River Tributaries Water Budget: Hydrologic Water Budget Model

- Distributed Hydrologic Model
  - NWS-OHD Research Distributed Hydrologic Model (RDHM)

Hydrologic and Surface Processes (HASP) Topics

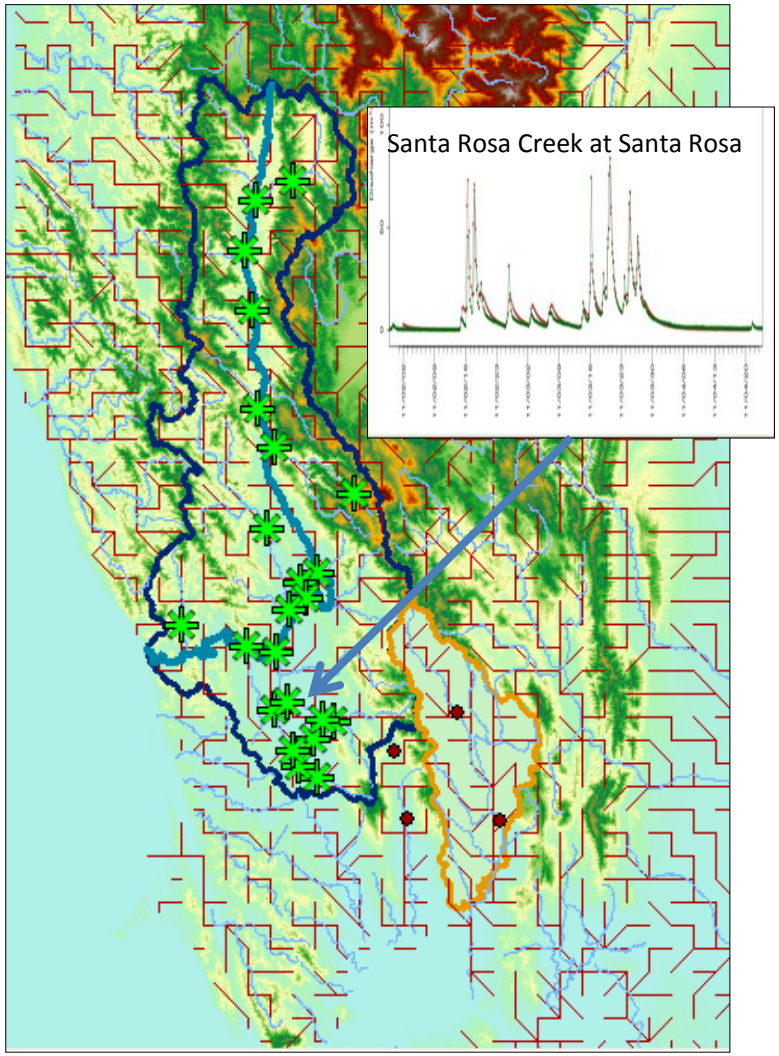
- Distributed hydrologic modeling
  - Russian-Napa Rivers
  - (N Fk American; Babocomari, AZ)
  - Setup, sensitivity, calibration, verification
  - Influence of scale
  - Flood and low flows forecasting
- Soil moisture
  - Monitoring – sensors, network
  - Validation of distributed model
- QPE and QPF
  - QPE validation with hydro model
  - HMT ensembles
  - Reforecasts
- Water Management
  - “Sea to Summit to Sea” integration
  - “Managed” flows
  - Operational science



Lake Mendocino

Russian-Napa Basins 2-D Model

- Purpose:
  - Account for spatial distribution of rain, topography, soils, land use and runoff
  - Tool to assess QPE/QPF products
  - Prototype forecasting deployment at WFO
- Research Distributed Hydrologic Model (RDHM)
  - Developed by NWS-OHD for nation-wide deployment
  - 2-D using HRAP grid (~4 km, ~ 1 km)
  - Gridded precipitation and surface temperature
  - Sacramento Soil Moisture Accounting Model (SAC-SMA) in each grid cell
  - Connectivity derived from DEM
  - Runoff (overland and channel) routed by kinematic wave equations
  - Soils parameters based on SSURGO
  - Channel routing based on USGS field measurements
  - Soil moisture linked to observations



MODSIM DSS

River Basin Management Decision Support System

- MODSIM is the longest continuously maintained river basin management software package currently available; freely downloadable - http://modsim.engr.colostate.edu
- MODSIM is designed as a generalized river basin management decision support system (DSS) tool for developing strategies for
  - a) short-term water management,
  - b) long-term operational planning.
  - c) drought contingency planning,
  - d) water rights analysis,
  - e) resolving conflicts between urban, agricultural, and environmental concerns
- MODSIM is designed to aid stakeholders in developing a shared vision of planning and management goals, while gaining a better understanding of the need for coordinated operations in complex river basin systems that may impact multiple jurisdictional entities
- MODSIM-DSS has been
  - linked with USGS stream-aquifer models for analysis of the conjunctive use of groundwater and surface water resources.
  - used with HEC water quality simulation models for assessing the effectiveness of pollution control and reservoir release strategies
  - used with ArcGIS for managing spatial data base requirements of river basin management
- John W. Labadie, Civil and Environmental Engineering, Colorado State University

MODSIM RIVER BASIN DSS